

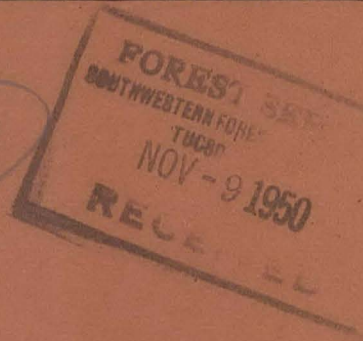
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FORESTS AND WATER IN THE RIO GRANDE RIVER BASIN

United State Forest Service

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE



FORESTS AND WATER
IN THE RIO GRANDE RIVER BASIN



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FORESTS AND WATER
IN THE RIO GRANDE RIVER BASIN

Forest Land and Water Resources Relationships,
Problems and Programs

Forest Service
U. S. Department of Agriculture

Prepared in response to the letter of March 18, 1950,
to the Secretary of Agriculture from Leland Olds, Member
President's Water Resources Policy Commission.

June 1950

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RIO GRANDE BASIN

The Rio Grande Basin extends from the mountains of southern Colorado to the Gulf of Mexico and includes an area of more than 83 million acres in the United States. The Upper Rio Grande above Ft. Quitman, Texas, with an area of 40 million acres, and the entire Pecos drainage, with an area of over 28 million acres, are considered in this report. Because forest lands in the United States have little influence on the Lower Rio Grande and as adequate information is not available, it is not included.

The Upper Rio Grande is a long and narrow basin ringed by high mountains around the headwaters in Colorado and bordered occasionally by other mountain ranges and peaks in its southerly course through the heart of New Mexico and into West Texas. The Pecos River heads near the southern end of the Sangre de Cristo mountains in northern New Mexico, forms a parallel and adjacent basin on the eastern side of the Rio Grande proper, and flows into the Rio Grande about 400 miles south of the New Mexico-Texas line.

Topography, climate, and vegetation show a wide range

Elevations vary from 1,000 feet at the mouth of the Pecos to above 13,000 feet at its source, and to more than 14,000 feet at the headwaters of the Rio Grande in Colorado and northern New Mexico. The divides rise abruptly from 1,000 to 5,000 feet above the relatively level valleys and plains. Steep slopes are prevalent.

Precipitation varies from 8 to 10 inches in the lowlands of New Mexico to more than 50 inches in the high mountains of Colorado where

deep snow banks accumulate. In the lower valley two-thirds of the moisture falls during the growing season. In the high mountains winter precipitation is relatively greater and more important, particularly as a source of irrigation water.

The wide differences in climate, elevation, and topography give rise to a variety of vegetation types. These include: alpine grassland, mixed spruce-fir forest (with a little lodgepole pine in the north), ponderosa pine forest, pinon-juniper woodland, sagebrush and salt desert shrub, short grass, desert grassland and southern desert shrub. In area the desert-shrub types, grassland and pinon-juniper woodlands lead. Less than 5% of the land supports commercial coniferous timberlands.

The land ownership pattern of the 68 million acres considered is approximately as follows:

National Forests	11 percent
Public Domain and Grazing Districts	14 "
Indian lands	4 "
Other Federal lands	<u>5</u> "
All Federal lands including Indian	34 "
State lands	14 "
Private lands	<u>52</u> "
	100 percent

The national forests lie in a horseshoe-shaped band with the open end toward the south and the eastern arm straddling the Rio Grande-Pecos divide. The public domain and grazing districts are largely in western

and southern New Mexico. Most of the Indian reservations and tribal lands are in northern New Mexico. State lands are widely distributed. Privately owned land follows the streams and scatters out to take in valuable blocks of timber and grazing lands. It also includes a band of checkerboard railroad grant lands extending across northern New Mexico. There is a close interrelation in the use of all these lands and some of the major problems result from an unsatisfactory land ownership pattern.

Water is the limiting factor in the economy of the basin

Water guided the footsteps of the early Spanish explorers and settlers and is today the mainstay of human existence. All of the water in the Rio Grande is diverted for irrigation or municipal use before the river reaches Ft. Quitman, Texas. Likewise all of the headwaters flow in the Pecos is used for irrigation or lost and seldom reaches below the Red Bluff project just south of the New Mexico-Texas line.

Less than 2 percent of the total area is under irrigation and cultivation without irrigation is minor in extent. One million two hundred thousand acres are irrigated; 920,000 acres in the Rio Grande drainage and 280,000 in the Pecos. Water makes possible the main source of income for 350,000 people and to lesser extent for an additional quarter million residents of Albuquerque, El Paso, and other cities which derive considerable income from outside sources.

Irrigation enterprises vary from a few large developments, such as the Mesilla and El Paso valleys under the Elephant Butte reservoir and the Carlsbad project on the Pecos, to more than 100 small community

projects depending upon direct diversion or simple impoundments. These small enterprises support a population of over 35,000.

Crops produced are cotton, corn, and alfalfa in the south, fruits, cereals, beans, and chili peppers in the middle stretches, and potatoes and peas in the upper end. The annual value of all crops produced on irrigated lands is over \$100,000,000.

Irrigation far exceeds all other water uses. The wells that supply Albuquerque, El Paso, and other cities and the stream storage of Santa Fe and other communities are locally important but their aggregate consumption is relatively small.

Hydro-electric power is developed at Elephant Butte Dam and in small quantities elsewhere, but the total output is inadequate and is supplemented by local fuel burning plants. Except near the headwaters the possibility of future power development is not great. Navigation is non-existent although the Rio Grande is classified as a navigable stream.

The forest and range lands are related to water yield

The forested lands are the prime source of water. Although the exact amounts are unknown, the figures that are available leave little doubt as to the importance of timbered watersheds. The mountainous area above Del Norte, Colorado, has an annual yield of 710,000 acre feet or about ten acre inches for each acre in the 1320 square mile watershed, a large part of which lies within the Rio Grande National Forest. The 400 square mile high water yielding area of the Santa Fe National Forest supplies 120,000 acre feet annually to the Pecos. It is estimated that the Rio Grande National Forest alone produces 1,500,000 acre feet of

water, and that all the national forests together produce 80 percent of the water, although they occupy only 11% of the area.

Part of the water in some of the forested lands percolates deeply to recharge artesian basins such as the San Luis Valley and the Pecos below Roswell, New Mexico.

In contrast to these small, high producing forest areas are vast expanses of pinon-juniper woodland, sagebrush flats, grasslands and deserts that contribute but little water, if any. Due largely to overgrazing that which they do produce is silt-laden runoff, perhaps more harmful than helpful considering the erosion it leaves behind and the silt it brings into drainage channels.

The available timber supplies are mostly on national forests

The bulk of the remaining commercial timber is in the national forests. Private holdings have been pretty well cut over; the states have led in the early disposition of their timber; and the virgin stands on Indian lands are nearing an end of cutting. The present harvest is around 81 million board feet, of which 12 million come from Indian lands and 23 million from State and private lands. In the national forests there are 2,364,000 acres of commercial forest supporting a merchantable timber stand of 6.8 billion board feet. In addition there are stands of some consequence on areas which are reserved for protection of wilderness conditions, recreational use and other purposes. The annual cut from national forests is about 46 million board feet while sustained annual allowable cut is estimated at 96 million board feet.

Up to the present time cutting has been concentrated on accessible areas, principally in ponderosa pine types, at lower elevations. Spruce and fir constitute the main stands at high altitudes where precipitation is in excess of 28 inches per year.

Livestock production ranks high as a source of income

With the exception of the larger irrigation projects strung out along the main channels, livestock production is the leading agricultural enterprise. It is dependent upon forage of watershed lands and is rounded out by the feed production on irrigated farms.

The basin developed under a livestock economy. It has gone through successive stages beginning with early Spanish settlement under a more or less feudal system. It has felt the impact of the beef bonanza financed in part with foreign capital. Sheep and cattle wars have been fought within its boundaries. The livestock industry has been severely set back by droughts and unfavorable markets, but it still survives as a leading industry with an annual gross return of over \$50 million. It is big business in part with a few large operators controlling large holdings, yet much of it is little business at a subsistence level. It should always be an important part of the economy although relatively less so as other sources of income become better developed. Its future depends largely on sound management of water, soil, and forage resources.

Grazing of cattle and sheep is an important use of national forests and other forest areas. Some 68,000 cattle and horses and 190,000 sheep are grazed on national forests. At least some degree of grazing is permitted on 6,746,000 acres or on roughly 90 percent of these lands.

Recreation is an important source of income

The combination of picturesque topography and attractive climatic features attract hordes of visitors that might be termed the greatest "cash crop" of the region. They are attracted by the warm and dry winters in the south and cool and clear summers in the north. They come to observe the folkways of the Indians and the Spanish-American residents, the colorful mesa landscapes, and the rugged mountain wildernesses. From river source to mouth there is almost endless variety of attractions. These visitors are an important part of the economy and must be considered in the plans for further development. The cash returns from recreational activities are hard to measure because of the many intangible items involved. Present estimates show an annual income of \$150,000,000.

In 1949 nearly a million people took advantage of recreation opportunities on the national forests. These included hunting, fishing, winter sports, hiking, viewing the scenery, and picnicking. Six wilderness areas adding up to nearly 400,000 acres have been set aside and other uses restricted or prohibited. Some 120 recreation areas have been developed and throughout most of the national forest area recreation use has high priority.

Fish and wildlife provide a powerful attraction to sportsmen of the plains country and the mountain roads are well-used by cars with Texas and Oklahoma licenses. Residents of the basin are lovers of outdoor sports. In New Mexico, for example, it is estimated that one out of each five men hunts and that one out of four of these bags a deer.

The basin boasts some 1,400 miles of fishing streams and 2,500 acres of lakes located in the mountains of national forests. These waters abound with native cutthroat trout as well as planted rainbow, eastern brook, and German brown trout.

Wildlife and fish on national forests furnish the basis for much of the outdoor enjoyment. National forests furnish summer range and a part of the necessary winter range for large numbers of deer. Elk, and a few mountain sheep, range there yearlong. Antelope, once at low ebb, have responded to planting and protection and are now hunted, in season, on and around three national forests. Bear and mountain lion provide sport for the hunter who likes to follow the hounds. Here in the forests of this watershed are some of the few remaining places where Merriam's wild turkey can be seen, and hunted in season.

Land use problems involve all classes of ownership

The private, State, and Federal forest and range lands all contribute to the wealth and to the problems of the basin. All need to be brought into over-all planning and to be fitted into the rehabilitation and development program. Accurate information is not available and space does not permit a full discussion here of the problems and conditions on lands under all ownerships. Suffice it to note that most of the basin has suffered from overgrazing and that private, state, and federal lands have been very seriously and extensively damaged. Programs for rehabilitation of all lands are needed and doubtless will be submitted by agencies now dealing with or administering them, except possibly state lands. Few other areas have had the benefit

of the intensity of protection and management which has been given to the national forests. They are in generally much better condition than other areas as a result.

In the following pages some of the interrelationships are indicated and the general problems are touched on to help bring out the more specific problems and conditions on national forests in relation to the whole management problem. The national forests, although representing only eleven percent of the land, stand out sharply in their contribution of water, timber, forage, wildlife, and recreation. They occupy a key position in the economic pattern and unquestionably hold an important position in present and future security and wealth of the basin.

Resource Management Problems and Their Causes

Water and soils are at the same time the chief sources of wealth and of problems. In the Rio Grande problems of quality and quantity of water yield begin on the alpine sheep ranges and continue through the coniferous forests where sound harvesting practices may increase water yields and fires or careless cutting may increase erosion and sedimentation. Beginning with the pinon-juniper woodlands erosion and sedimentation problems increase and continue their major importance down through grassland and desert.

The clear mountain water, with maximum capacity for carrying silt, gathers it from eroding banks and from bars deposited by flooding tributaries. This sediment load adds an inch a year to the river bed near Albuquerque which is already three feet higher than parts of the city. Some of it is carried on down with further additions from

tributaries to be added to the 440,000 acre feet in the Elephant Butte Reservoir or dropped by the slowing waters above the reservoir. A yearly average of 18,000 acre feet of sediment entering the main river channel has reduced the reservoir capacity 17 percent in 35 years and is clogging the river bottom in intermittent deposits extending 200 miles above Elephant Butte Reservoir.

The situation is much the same in the Pecos with addition of greater salinity problems and dwindling ground water.

These sedimentation problems are by no means restricted to the main river channels. Wherever there is erosion and increased runoff in tributary drainages the effects are apparent downstream as flooding or sedimentation. Local damages, while often small in themselves, become great in the aggregate. Principal sediment-carrying tributaries are the Chama, Gallisteco, Jemez, Rio Puerco, and Salado Rivers. On all of these there are seriously eroding headwater areas, some extending onto national forests. The bulk of the sediment, however, has its origin on other lands.

Water supplies are perennially short of demands and this becomes acute during periods of drought when crops, livestock and even municipalities suffer. Locally in mountain valleys shortages occur before the end of the growing season because the storage capacity of watersheds has been impaired.

Industrial pollution is not serious as few industries are based on heavy water supply and disposal. On national forests a small but serious problem exists in pollution of nearly all springs which serve recreation areas.

Even with reasonably effective protection being given to many of the more important water yielding areas, particularly in the national forests, the flood and sediment situations in the Rio Grande and Pecos Valleys are extremely serious. The problems, in their abnormal and more serious phases, stem almost entirely from depletion of vegetal cover under a pastoral economy. Fires and severe timber cutting in some forest areas have caused some damage, and unsound farming practices are responsible for much local erosion. But all these are minor in comparison to over-use of much of the range which is responsible for widespread erosion. The hydrological functioning of the basin has been altered from one of slow watershed runoff and rapid stream flow to the reverse. Watersheds now discharge their muddy torrents promptly, but valley stream flow is retarded and spread by sediment and riparian vegetation. Extreme examples of this are found in the water consuming growths of salt cedar above reservoirs in the Pecos as well as the Rio Grande.

Over-use of range has brought about serious conditions

On far too much of the range land the original vegetation has been reduced or seriously depleted, valuable forage species have been thinned out or have entirely disappeared, entire plant communities have been replaced by less productive types, and unusable weeds, shrubs, and trees have invaded and successfully competed for the scanty and ever decreasing soil moisture. Surface litter accumulated over the years has been reduced or has disappeared entirely. The spongy surface soil has been compacted, washed or blown away. Moisture penetration has been retarded, surface flow resistance reduced, resulting in lessened soil moisture

which, in turn, results in a more scanty cover. Small waterways and gullies have formed to facilitate the runoff of silt-laden water. The semi-desert grasslands, the pinon-juniper woodland, and the sagebrush lands have suffered the most but all types show deterioration in places.

It is estimated that 30 percent of the national forest range is in unsatisfactory condition while 4 percent is in critical condition. A range inventory would include such disturbing items as: loss of grasses and herbaceous vegetation resulting in erosion on alpine sheep ranges; weeds or bare ground in place of the former bunch grasses on mountain meadows now drained by gullying; unproductive weeds and short grasses replacing bunch grasses in pine stands; degeneration to snakeweed and other inferior species on extensive areas of pinon-juniper woodland; loss of all ground cover and most of the soil from some portions of the same woodland.

The range management task that lies ahead on national forests, but especially outside, is to reverse these processes, to hold the soil so as to rebuild its fertility and improve its moisture capacity, to retard the silt-laden runoff of negative or at best doubtful value elsewhere, to rebuild the cover of vegetation to efficiently producing forage types that will contribute maximum benefits to the end that watersheds important to the basin economy produce the greatest good for all concerned, the range user himself as well as the large and diverse community of which he is a part.

The economic situation of the dependent population, particularly in northern New Mexico, is a factor in the situation. Here, nearly

every small valley has its Spanish-American or Indian village and each canyon has a few houses. Existence is eked out on a farmer-stockman basis with a few acres of cropland and generally less than ten grazing animals per family.

In the vicinity of these canyon settlements, overgrazing was prevalent before the arrival of the American pioneers. To reduce the grazing permit of a family by one head often means to take away ten percent of more of the national forest permit, and to lower the family's income by what to it is a large amount. And yet, as offspring follow in profusion they settle themselves in the same situation and cause further subdivision of the modest and vanishing resources. Trespass stock have sometimes exceeded permitted numbers and constitute a large part of the problem.

Timber problems reflect differences in forest types

Although cutting on national forests has been conservative generally, the more important timber problems/relate to too much cutting in some places and too little in others -- on the one hand harvesting everything that would sell regardless of the consequence to forest regeneration or accelerated erosion, while on the other hand large areas of virgin timber are yet untouched.

The more accessible ponderosa pine stands have been cut over. On national forests and Indian lands harvesting has been aimed toward sustained yield, but on state and private lands heavy cutting has been the rule and there has been little effort to provide seed trees and other aids to regeneration. In the past, and to a lesser extent now,

Fires were allowed to burn through cut-over stands on non-federal lands. In many cases heavy grazing became an additional influence in the deterioration of the forest lands.

Pinon-juniper woodlands, with the exception of some small areas, have supplied few wood products. It is hoped that forest products research may find additional uses, but at present pinon and juniper fall largely in the category of "weeds", although they do furnish food (pinon nuts), fuel, and fence posts to a limited extent. In many areas they add to the erosion problem, because the combination of woodland trees and heavy grazing spells scanty herbaceous cover regardless of land potentialities. Usually these woodland stands are on shallow, highly erodible, infertile soils where the herbaceous cover maintains a precarious existence at best. Not much grazing is needed to bring on disaster.

Spruce, fir and lodgepole pine forests of the higher mountains have remained in a near virgin state because of inaccessibility, harvesting costs and low salability. These forest types will present many problems of harvesting on which additional research is needed because of inaccessibility and their importance for watershed protection.

Research has already made important findings in regard to the management of these high mountain forests. Experiments have shown the possibility through sound cutting practices of modest increases in water yield without increasing erosion rates. At the same time the growth rate of the forests may be increased three or four fold. There

is also a growing interest on the part of commercial operators in these timber species.

Before logging of these species and remaining stands of ponderosa pine can be accomplished, costly access roads must be built into the mountains. Construction at public expense seems inevitable as the small operators who predominate in the economy are unable to provide the type of road developments that sustained yield requires. Public expenditures for roads will be returned to the Federal Government in the form of enhanced value of stumpage when it is sold and in increased yield of timberlands under adequate management practices.

The hazard from lightning-caused fires is moderate, but those caused by ever-increasing numbers of recreationists and other visitors to national forests are increasing. Facilities and equipment for use in detection and suppression are to some degree insufficient, access is difficult where roads and trails do not exist, and trained personnel are few in number to meet increased fire incidence. Cooperative arrangements are lacking for control on much state and private forested land. Where cooperative agreements do exist on these non-federal units the burden of fire protection falls on Forest Service forces which are undermanned for the task on national forests alone.

Recreation is Related to Other Land and Water Uses

Outdoor recreational activities are creating more and more demand for suitable facilities to take care of local residents and visitors.

The land ownership pattern seriously complicates recreational use. Much of the attractive desert, grassland, woodland, and forest land is in private ownership, and public use is often in conflict with private interests. The states have done little to meet recreational needs on their own lands. Provision for recreational use on a broad scale is only found in national forests and in national parks and monuments. Because of the present land use conflicts and the inadequacy of recreational opportunities, there is a growing need to acquire desirable recreational lands for public benefit. Public ownership would also foster watershed protection.

Recreation use poses many problems related to water. Clear water whether it be in streams, lakes or reservoirs attracts people. This points to the need to provide proper facilities for enjoyment and sanitation. The economic importance of recreation also places it in a strong position for consideration in future water developments. Fishing, boating, swimming and camping have a strong public appeal.

The problem of providing recreational facilities to meet the demands on national forests is rapidly becoming more acute. The use of recreational facilities doubled between 1942 and 1949 and the use will probably double again before 1960. No new construction funds have been available during this period and maintenance funds have been totally inadequate. It has been a losing struggle to hold sanitary facilities, garbage disposal, and repair work at a satisfactory level. Problems of sanitation and water pollution are acute in many areas.

Wildlife problems are widespread

The variation from desert to alpine meadows, the variety of land uses, the desires and ambitions of local residents and tourists, the land ownership pattern and the needs and characteristics of fish and wildlife give rise to many complex problems.

The national forests occupy a unique position in the fish and wildlife picture. They provide the food resource and a suitable environment for reproduction and growth, yet the physical control rests largely with the States and the ability of hunters and fishermen to maintain proper population control. In many instances game animals range part of the year outside the national forests. This puts the Forest Service in the position of steering the game management car while someone else handles the accelerator and brakes.

Right now there are four elk herds and four deer herds on national forests which verge on population eruptions that may cause undue damage to watersheds if not closely regulated.

A broad approach is needed to solve these interrelated land and water management problems.

A superficial approach to water problems by means of replacement reservoirs, more and higher levees, dredging channels and using other engineering devices for the alleviation of flood and sedimentation damage may give some immediate relief, but lasting economic welfare depends on bringing every acre of the Rio Grande and Pecos drainages back to a state of optimum productive health. It will require the best of both engineering works and watershed management to get the job done.

The resource problems must be met and solved on all the lands whether they be privately or publicly owned; on the millions of acres of private lands where too often "profit taking" has been the guiding force; on state lands subject to the stresses of political pressure; on lands too long-suffering from "public domain" vicissitudes and not yet fully on a desirable management level; and on the national forests where inadequate funds and lack of general public support have hampered sound management.

The situation is not all bad. There are range lands that have remained in good condition and there are others that are being improved. There are the national forests where timber stands have been well managed, and some progress is being made in the management of state and private lands. Fire protection has been extended and improved in a few places. Conservation gains are being made but they are slow and small compared to the great need to reverse the general downward trend. The general solution requires cooperation, coordination and a helping hand from agencies and individuals in a position to give aid.

The national forests have had a very important influence on water. Without the protection they have afforded to the headwaters the situation would be many times worse. There are yet many problems within the national forests to be overcome. Increased financial support is needed to carry out management and improvement on a scale commensurate with the problems and values involved. The national forests can then provide their full quota to social and economic welfare and serve as examples to help bring the remainder of the lands to the point of over-all optimum returns.

Special problems affecting solution

The "Rio" is following that historic course back to desert that has attended civilized occupancy of semi-arid lands. A full awakening to this fact has not occurred, and least disturbed over the trend are the residents of the valley. Evidence of public lethargy is seen in many directions. Overgrazing, and defense of the right to overgraze regardless of consequences, is one of the manifestations. Others appear as opposition to orderly planning and regulation to protect valuable resources; and as stubborn opposition by downstream water users, to programs of upstream improvement, on the general hypothesis that water yields might be lowered.

As would be expected, this spirit of opposition is reflected into state legislation and administration. It results in inadequacy of legislation and appropriations covering forest and watershed conservation. It appears further in the permitted abuse of state lands which are clear-cut and leased for grazing without restrictions on use. State lands in general are in the worst condition of any ownership category.

There is powerful organized and individual resistance to stock reductions on public land. Ignorance and disregard for the need to preserve soil and other resources foster the popular belief that a blade of grass uneaten is one wasted.

Although there is little or no serious conflict between federal agencies operating in the basin, there are serious differences of viewpoint which hamper a coordinated attack on major problems. An example is land acquisition which the Forest Service holds is necessary for

consolidation and control of strategic watershed lands. Other viewpoints are based on control by contract or incentive arrangements.

Another example is the difference in objectives as influenced by primary bureau function. Some agencies have been inclined to go ahead with main channel improvement and neglect the need for over-all watershed planning and improvement which should be done first.

Present operation of federal mineral claim statutes handicaps land management on federal lands which are open to filing of claims. No control over surface rights is provided in the interest of watershed protection. Another loophole exists in the fact that sites having superior worth for public enjoyment because of their beauty or recreational values cannot readily be reserved for that purpose against filing of mineral claims.

Existing codes for evaluating conservation benefits fail to recognize social and other so-called intangible benefits in a material sense as an offset to costs. Whenever economic practice discounts future benefits of forestry and conservation as being of less value than those maturing in the present the logic may be faulty. With constantly expanding population resources are likely to become more precious with passage of time.

Present Program and Future Needs

National forests

The present program of the U. S. Forest Service is largely concerned with the management of 7,500,000 acres of Federal land including all or parts of seven national forests. These include about half of the total

acreage classified as forest and 10 percent of the range land. All of the land is watershed, although a portion drains into interior basins.

Management is based on highest use within a general multiple-use framework. Watershed protection ranks high and other uses are conditioned by the requirements of sound watershed management. While timber management, range and wildlife management, and recreation are handled on a functional basis, their policies and programs are founded on the interrelationship with water and soil.

Timber management involves protection, management, and harvesting

Starting with mostly virgin forests the timber management job has been to protect the timber resource from fire, insects, and disease while developing sustained yield through planned harvesting of mature and overmature stock and thereby increasing growth rate on younger, more rapidly growing trees. So far harvesting has been largely limited to ponderosa pine. High logging costs and lack of demand have restricted sales on the less accessible areas, particularly for the less desirable spruce, fir, and lodgepole pine. At the present, protection is the chief item in the management of these remaining virgin forests.

The activities concerned with timber management and protection include timber surveys; timber sale administration, including slash disposal and stand improvement; control of insects and disease; fire prevention and suppression; and general supervision of a living resource.

The performance of these tasks requires physical equipment such as: an adequate road system for timber harvesting, fire suppression and general supervision; fire detection equipment such as lookout towers,

telephone lines, airplane fire detection and control service, and radio equipment; fire-fighting equipment of many kinds; and living and working facilities for the supervisory personnel.

A good record has been maintained in fire detection and suppression, but insects and diseases have not been adequately controlled. Shortage of manpower has hampered timber-sale activities, and stand improvement has not been up to desirable standards. Timber surveys have barely kept ahead of timber-sale needs.

More intensive management of the timber resource is needed.

Rapid changes have been made in timber economy in the last few years. Stumpage values have been high and demand has increased. If this trend continues timber management activities should be materially increased during the coming years.

Watershed and timber values call for greater protection from fire, insects, and diseases. Reforestation of damaged areas is needed. More roads are needed for protection and management. More timber sales would be made if road-building costs could be spread over a longer period through Government financing. Also fire protection, general administration, and recreational use would be facilitated.

Better and more complete coverage by forest surveys and inventories is needed to aid management. Much more is needed in the way of manpower and facilities to keep up with the accelerated management tempo. In the past forest management was largely devoted to guarding the storehouse. Tomorrow it will be more concerned with the marketing of the slow-growing virgin timber and growing timber four times as fast.

National forests should be expanded

Not all forest lands have had the advantage of the conservation afforded on national forests. This is particularly true of private lands which in most part are badly deteriorated. Some 620,000 acres inside national forest boundaries and 1,454,000 acres located just outside should be purchased and added to the national forests. These include cut-over timber lands, low-value forest lands, submarginal and abandoned farm lands, and some deteriorated range lands. All of these are important watershed lands needing the protection and management that private ownership cannot afford to supply. Some progress has been made through the exchange of timber and lands for forest lands needing protection. Around 300,000 acres have been added, but the net gain is about half of this as some lands have been given in exchange. In addition to these private lands 423,000 acres purchased by the Resettlement Administration should be added to the adjacent national forests.

After acquisition all of these lands will need to be rehabilitated as rapidly as possible. This will require planting, range reseeding, erosion control works, road construction, fencing, and other aids to recovery.

Range management on national forests involves range inventories, administration and improvement.

The starting point in range management was far different than that in timber management. Virgin range was rare if it existed at all. Demand for range exceeded the supply, and use tended to exceed production. The task in range management has been to regulate use and manage the

range with sustained grazing capacity and optimum watershed conditions as the goal. A great deal has been accomplished, but there is much yet to be done. About 34 percent of the national forest land is considered to be overgrazed at the present time.

The activities concerned with range management include range resource inventories, preparation of management plans, range supervision and inspection, special studies, and the multitudinous duties related to grazing permits and administration, including the difficult task of reducing livestock numbers to grazing capacity of the lands.

Range management requires fencing, water development, range reseeding, rodent control, noxious weed control, and various livestock-handling facilities.

More intensive range management is needed on national forests

Stepping up the range management program is an urgent need. Range deterioration is cumulative; each year the effects of overgrazing are compounded and the problem becomes greater. Increased manpower is needed to complete urgent range-resource inventories as a basis for more adequate range management plans. More intensive supervision and closer measurements of range use and its effects on forage and soils is an essential requirement to maintain upward trends in range condition. More fences, water developments, and other improvements are a necessary adjunct to improved range management. Range reseeding is needed on some 200,000 acres to restore their productivity and to help carry the grazing load. Restorative measures are needed on badly depleted and eroded lands. Rodent and noxious weed control will do much to hasten recovery. All in all, there is a great deal to be done.

Recreation and wildlife management needs are increasing

Recreation and wildlife, while recognized at the outset as items in the multiple use on national forests have far exceeded their original importance. Both fall in the general category of "free use" with nominal charges made for a few minor services and facilities.

The activities concerned with wildlife management are in general much the same as those for managing domestic livestock, but with such differences as are inherent with a wild population.

Recreation is making ever greater demands for facilities--picnic grounds, campgrounds, winter sports facilities, sanitation facilities, roads, trails and services of one kind or another.

There is a great need for adequate financial support to take care of the important and rapidly expanding forest uses related to fish, wildlife and various recreational activities. The requirements include both use facilities and habitat improvement.

Regular services for non-Federal lands

Of the six million acres of forest land in state and private ownership only five percent is classed as commercial timber land. Yet these state and private lands have supplied a great deal of the timber in the past. Their supplies are nearing exhaustion and little provision has been made for regrowth.

The situation clearly indicates needed action. In some cases public ownership is required to restock and rebuild the timber stand. This is particularly needed on lands with high watershed values. In some

instances the present owner can successfully handle the situation if he is given technical assistance and other proper public aid including credit. Federal, State and local regulations to protect both the individual and the public interests are also needed to prevent further "mining" of the already depleted stands.

Relatively little has been accomplished under the Clarke-McNary and Norris-Doxey forestry aid acts. Colorado and New Mexico have Federal aid fire protection programs. The Texas program is not active in this part of the State. In New Mexico fire protection is afforded to some forest lands within and adjacent to national forests under cooperative agreement with the owner. The land owner pays a proportionate share of the costs.

Public aid in supplying tree planting stock at a low cost has not had any appreciable effect on reforestation.

At the owner's option and under cooperative agreement, the Forest Service has supervised timber sales on some state and private lands. However, it has not been possible to maintain national forest standards in the administration of these sales.

In addition to the commercial timber land there is a much larger acreage of non-commercial forest land that is in need of better management. This is particularly true of the extensive stands of pinon-juniper which are forest-range hybrids with neither of the components of any great value. A large part of this pinon-juniper woodland is in state and private ownership. It is also in deplorable condition. Public values are high, as much of the troublesome sediment comes from these

lands. This is one of the major problems that needs full Federal, State, and private participation for its solution. Public acquisition, stronger and a higher standard of state supervision, public regulation of cutting and other forest practices, education, and technical aid are needed.

Research and surveys

The research program of the Forest Service is limited to a study on one experimental range in the semi-desert grassland near Las Cruces, New Mexico. The experimental work is pointed toward determining the methods of grazing management which will provide maximum forage yields, consistent with soil stabilization. The only other grazing management research is being conducted by the New Mexico State College in the same vicinity. A start has been made in range reseeding research in northern New Mexico.

There is no forest management or watershed management research at the present time. Some of the research in adjacent basins will apply in part, but does not fill many of the pressing needs in the Rio Grande Basin.

More basic information is needed on precipitation, characteristics of stream flow, nature and source of sediment production and plant-soil-water relationships. Such studies are needed for all vegetal types. Timber harvesting methods to provide optimum regrowth and timber production need to be studied in the spruce, fir, and lodgepole pine forests. The management and harvesting of second growth ponderosa pine needs the guidance of additional research. The relation of timber cutting to water yields is another important problem. Little is known about fuels,

fire danger and fire behavior, and more information is needed on what and how to plant and restock burns. New logging methods need to be developed for economical harvesting. Utilization of aspen, fir, pinon, juniper and other secondary species, and the waste left in woods is an important problem to be studied. Grazing management research on alpine sheep ranges, pinon pine and grassland ranges is particularly needed, but there is a great deal of research needed on all ranges. Range reseeding research needs to be greatly speeded up in all vegetal types.

Encroachment on grazing lands of such invading species as mesquite and juniper needs investigation. Ways and means of controlling riparian vegetation such as salt-cedar must be devised to save water supplies.

There is also a need for surveys and mapping to provide aerial planimetric, topographic, and other needed maps for all areas, and large-scale resource photography for high value timber stands. Resource surveys and inventories should cover water, floods, sedimentation, soils, the timber and the range resource. The coverage now provided by snow surveys, precipitation and sediment measurements, and stream gaging, fails to provide a base for comprehensive planning in connection with the water resource.

The magnitude of the needs to be taken care of in the proper management of forest, range, and watershed lands within the scope of Forest Service activities is indicated in the summarized table below which compares present expenditures with recommended expenditures under the proposed program.

Comparison of present expenditures and recommended program needs
for Forest Service activities in the Rio Grande Basin

	<u>Present</u>	<u>Recommended</u> <u>1/</u>
For national forest lands		
Non-recurrent	12,032,000 <u>2/</u>	125,000,000 <u>3/</u>
Annual recurrent		
on present programs . .	982,000	1,450,000 <u>4/</u>
For forestry aid to		
State and private lands .	14,000	124,000
(annual)		
For research		
Non-recurrent	—	1,362,000
Annual recurrent	33,000	546,000

1/ Estimates for the recommended program are tentative, subject to revision and are not to be published. Recommended investments are in addition to present investments; recommended annual expenditures include the present level of expenditures.

2/ Present capital investment.

3/ Includes land acquisition and development of acquired lands.

4/ Estimated annual expenditures needed to provide an acceptable standard of national forest protection and management based on existing improvements and operating facilities and current level of business.

POLICY PROBLEMS AND RECOMMENDATIONS

The following recommendations are applicable not only to the Rio Grande Basin but also to other river basins. They were selected as being of particular significance to this basin.

1. Coordinated planning: Both the Rio Grande and Pecos Rivers have been subjected to considerable development for irrigation and flood control. Piecemeal engineering activities are pretty much scattered from the headwaters to the mouth of the streams. In their entirety they represent a very large investment in irrigation works, flood-control structures, power plants, and reservoirs. The usability of stream channels, irrigation canals, and reservoirs must be perpetuated. It is imperative that destructive land-use practices be eliminated. Comprehensive plans and programs for the watershed lands are far behind the developments of the rivers themselves. Sound water-resources policy requires coordinated planning for conservation practices on the land and for development of the water resources of the streams. To attain this objective it is necessary that planning for the development of the watershed should be carried on at an accelerated rate.

2. Watershed management: Vegetative cover helps reduce floods, regulate stream flow, and stabilize soil. Domestic and irrigation water supplies and hydroelectric power are all influenced tremendously by forest and range conditions.

In the Rio Grande Basin, more than four-fifths of the water that appears in usable stream flow falls on forest lands. The management

of all these lands, therefore, assumes an importance far greater than can be measured by the timber and forage they produce, the wildlife they harbor, and the recreation they afford.

Generally, the problems these lands present arise from deterioration or depletion of the vegetal cover through lack of adequate protection and through mismanagement for other use. The problems are made more difficult by the mixed land ownership and by the pressure of use on the part of many small owners. The management of these watershed areas calls for close coordination and cooperation on the part of Federal, State, and private interests.

Watershed protection was one of the major purposes in the creation of the national forest system. Yet, aside from protection from fire, we have been more concerned with timber, range, recreational and wildlife resources than with water. Generally, timber harvesting, grazing, and recreational use may be carried on under appropriate control without serious impairment of the watersheds. This is the objective of the multiple-use policy which has guided national forest management and sets it apart from private forest management. In some critical localities, however, other uses must be restricted to protect watershed values. Research is showing how timber cutting and range use can be coordinated with watershed protection. But we have only begun to understand the complex relationship involved, and have made too little progress in measures to maintain watershed values, increase water yields, or rehabilitate damaged watersheds.

The value of the national forests as sources and conservers of water in the Rio Grande and Pecos River basins and elsewhere should be recognized. Provision should be made for reseedling on seriously deteriorated rangelands and for restoring protective cover by forest planting on areas denuded by fire and other causes. Protection against fire, insects, and diseases should be intensified. Commercial forest areas should be made accessible by road construction. Adequate provision should be made for integrated and coordinated development of all national forest resources, including necessary surveys and plans.

Programs for national forest watershed management should be supplemented and supported by parallel plans for adjacent and intermingled lands. Many lands in other ownerships, whether public or private, are not up to national forests in standards and practices for watershed protection. Nevertheless, many of the problems are common to all.

Lack of adequate watershed management is costing the people of this country much every year. Good watershed management, in fact, is essential to the life of much of the economic development based on our water resources. More than that, it is also important to the farm, forest, and range economy, especially in the West.

3. Watershed damage from overgrazing: Use of public and private rangelands by both domestic livestock and game should be adjusted to the carrying capacity of the range and depleted range vegetation restored as rapidly as possible. These objectives should be included

in national water policy as an essential means for bringing about good watershed conditions which will minimize erosion and reduce accelerated surface runoff.

Overgrazing on public and private rangelands is a primary cause of damage to watersheds in the basin. Watershed conditions are deteriorating further and potential range capacity is being lost. The consequences of too heavy grazing include progressive deterioration of the vegetative cover and soil resource, accompanied by accelerated surface runoff, erosion, and sedimentation. Increased flood damages follow, particularly in the tributaries.

It is the policy on national forest ranges, at least, to adjust range use to range capacity and to rehabilitate depleted ranges. Necessary reduction in livestock numbers grazing upon the national forests of the basin are being opposed by organized stockmen. The result is that adjustments are being delayed. Greater public support for the efforts of the Forest Service is needed to make them fully effective.

4. Land resources and dependent rural populations: In northern New Mexico particularly there is a large rural population of Spanish-Americans and Indians. They are located where small perennial streams come out of the mountains and small irrigable valleys are handy to grazing lands and to the fuelwood of the forests. These people, with roots in the soil for many generations, have preferred not to move away in spite of increased pressure on the lands which are constantly deteriorating. The average family size is five; the family income is about \$500 per year including wages earned away from home. Nearly one hundred small communities, aggregating about 35,000 people, are

principally dependent on water and forage of the national forests. The unremitting grazing pressure exerted by this situation is an important cause of depletion of cover and erosion on national forests.

Planning for the integrated development and improvement of land and water resources of the basin should give special consideration to means for bettering the economic status of these communities and thereby reducing the continuing damaging effects on the basin's resources.

5. Public acquisition of critical watersheds: There should be Federal authority in flood control programs to acquire land of any sort above river projects when necessary to prevent damaging sedimentation. Such lands should be added to the national forests wherever they can be effectively administered as such. This is a major problem in the Rio Grande and Pecos basins. Because of the low productive capacity of many of the watershed lands, it does not seem possible for them to be given the proper management under private ownership. It is essential that some public agency make investments in these lands for the protection of downstream interests.

6. Public zoning of flood damage areas: The Federal flood control statutes should be amended to require that States and their local government units--as one of their contributions to a comprehensive river basin flood control program--shall provide effective zoning to prevent the further occupation of dangerous flood-plain lands by industrial and residential installations. As a corollary of this requirement, the Federal Government should have authority to acquire areas subject to frequent flood inundation and to use them for suitable purposes.

7. Multiple use of forest lands: The multiple-use principle should have wide application in the management of watershed lands, especially those in public ownership. All the goods and services the forest can render should be developed under careful planning to protect and enhance watershed values.

Good watershed management rarely precludes other forest uses. Where damageable values downstream are high, soils unstable, and runoff problem serious, watershed protection may make it necessary to forego one or all of the human uses to which the forests might otherwise be put. However, in most areas the forests may yield timber products, provide forage for livestock and game, afford opportunities for recreation, and in other ways produce returns without serious detriment to the watershed. The nature and intensity of use should of course conform to requirements for soil and water flow stability.

Even on municipal watersheds it should seldom be necessary to exclude logging, grazing, or agricultural use except for critical areas such as those along reservoir margins and feeder streams.

The classification of lands with respect to priority of watershed values and their sensitivity to damage should be undertaken as needed to guide watershed management and use.

8. Conflicts over the use of water by vegetation: Some downstream water users oppose watershed restoration programs because of their belief that to increase the present depleted vegetative cover on eroding lands will result in reduced water supplies downstream. These people generally admit seriousness of sedimentation but propose to meet it by costly replacement reservoirs.

A more intensive research program is needed to establish factual data on the effect of vegetation on water yield. This should be supplemented by an educational program to acquaint the public with the pertinent facts. Other agencies engaged in water development should recognize this upstream need for water and make provision for such use.

9. Water for recreation and wildlife: Recreation and wildlife rank high in the Rio Grande and Pecos river basins in economic importance. In all developments for irrigation and flood control, ample provision should be made for recreation and wildlife. Provision should be made for uniform stream flow insofar as practical, and in any case for an amount of water for wildlife and recreation that will not be reduced below the normal low-stage flow of the stream. In the construction and use of reservoirs, consideration should be made for delaying drawdown as late in the season as possible and to change reservoir levels as slowly as possible.

10. Public acquisition of land at reservoirs for recreation:

A legitimate portion of reservoir cost should be allocated for development of recreation including land purchase. The acquisition of land around existing reservoirs as well as for future reservoir developments should include sufficient area above maximum water level to provide for full public development of recreational opportunities. Past experience has shown the urgent need for ample provision for recreational activities adjacent to reservoirs. The purchase of lands sufficient only to meet the requirements for control of reservoir operation often excludes nearby lands highly useful for recreational development.

Such lands may indeed be the key to complete development of important recreational opportunities. Under private ownership such lands might and often have been developed in a manner incompatible and even detrimental to public interests.

11. Disruption of national forest resource services and facilities:

The act authorizing a Federal agency to build a dam which would impair national forest administration and services should include authorization to expend as part of the project cost such sums as the Secretary of Agriculture considers necessary to correct the impacts on national forest resources and services resulting from the reservoir developments including plans and surveys by the Secretary of Agriculture.

Reservoir planning should take realistic account of replacement of national forest facilities and services destroyed or made useless by reservoir construction. Consideration should also be given existing and potential use of land and resources. Replacement of facilities should be on the basis of equal utility not merely in kind. Also, reservoir planning should be integrated with existing land and resource development plans so that reservoir benefits may not be at the uncompensated expense of other resource benefits, such as sustained yield of private and public timber, and a portion of project planning funds should be available to the Forest Service for this purpose.

12. Revision of mining laws: The Federal mining laws should be revised to provide for regulation of mining operations on Federal lands to control erosion and sedimentation of streams. This would require either: (1) revision of the mining laws to institute the leasing system covering all minerals, or some effective alternative; or (2) withdrawal of critical watersheds from damaging mining development.

In the Rio Grande and Pecos River basins, fraudulent mining claim entries are being made upon lands chiefly valuable for other uses such as summer homes or commercial development. Better control is also needed for the development of legitimate claims for pumice and other building materials. Uncontrolled mineral entries, whether legitimate or not, often seriously interfere with other land uses which may be of greater public benefit.

13. Withdrawal of national forest lands: No disposition of national forest lands for reclamation or other purposes should be made, and no leases, licenses, or easements affecting such lands should be granted without the concurrence of the Secretary of Agriculture.

Under certain existing statutes, other Federal departments possess an overriding authority over national forest lands for certain definite purposes. For example, the Reclamation Act gives the Secretary of Interior authority to withdraw national forest lands for first-form reclamation withdrawals and to construct and operate reclamation works thereon. The Secretary of Agriculture has no authority to disapprove such action regardless of possible deleterious effect on national forest administration or management.

Several other acts give the Secretary of Interior authority to grant easements over national forest lands. There is no statutory provision for approval or disapproval of the Secretary of Agriculture.

14. Regulation of private forest cutting practices: There is a nationwide need for establishment of a system of public regulation of cutting and other forest practices that will stop forest destruction on private forest lands and keep them reasonably productive. This

need is exemplified on conditions on private lands in the Rio Grande and Pecos River basins.

The States should continue to have opportunity to enact and administer adequate regulatory laws. However, in order to insure a consistent pattern-- nationwide and in time--a basic Federal law is needed. This measure would complement public aids and technical services to private owners and educational efforts which should be continued and strengthened.

The Federal legislation should establish standards as a guide for local forest practices and authorize Federal financial assistance to States which enact and administer regulatory laws consistent with Federal requirements. It should also provide for Federal administration in States which request it or which, after a reasonable period, fail to put such regulation into effect.

A survey made in 1945 of the character of timber cutting on private lands in the basin showed that much of it was poor or destructive. As a result of past poor practices and fire, a large proportion of the private land is non-stocked or poorly stocked with seedlings and saplings.

New Mexico has had a forest practices act since 1939. However, the act is seriously deficient in important respects, and facilities for enforcement are virtually lacking.

15. Preservation of wilderness areas: The preservation of primitive country for enjoyment of wilderness recreation is an established policy of the Forest Service in administering the national forests. Improvements are limited to trails, essential protection developments, and sanitary improvements at camping spots where necessary. In the Rio Grande and Pecos River basins there are areas aggregating more than 400,000 acres that have been set aside as wilderness reservations.

These areas have relatively low values for other purposes, but do have a high esthetic value and provide important watershed protection. Their perpetuation needs to be a part of the over-all conservation program for the basins.

There are two threats to this program which are presently beyond the control of the Forest Service and the Department of Agriculture. First, since those areas are in lands withdrawn from the public domain for national forest purposes, they are subject to mineral location under the U. S. Mining Laws. Second, water impoundments may be planned for development on national forest lands, including wilderness areas, without the consent of the Secretary of Agriculture.

Authority should be lodged in the Secretary of Agriculture to meet those threats when the values for wilderness recreation outweigh benefits that might be derived from mining development or water impoundment. This would require: (1) revision of the mining laws; (2) provision for full consideration of conservation values before a water-development project is planned.

16. Financial contributions to local government: Contributions to local government on account of Federal forest and rangeland should be, as nearly as practicable, a uniform system of payment determinations based on a reasonable percentage of fair value. This ratio should be less than that ratio of property taxes paid to fair value because of contributions in kind by the Federal Government, such as forest fire protection furnished by the Federal Government. The ratio of three-quarters of 1 percent of fair value is recommended as the standard. Existing practice has no consistent policy basis. For example, grazing

districts contribute 50 percent of gross receipts; national forests contribute 25 percent.

17. Basic data and research: There is need for much additional basic data for watershed management covering, in addition to cadastral and topographic surveys, such things as soils, precipitation, snow pack and snow melt, stream flow, siltation, and water quality. The research program in forest management, fire control, range management and reseeding, forest resource and economic problems, and forest products utilization needs strengthening and intensifying in the Rio Grande and Pecos river basins to supply the basic needs for multiple-use management of the forest and range resource.

